CLAIMS

1. A syringe intended for the parenteral injection of a semi-solid formulation, comprising a hollow element forming a reservoir (1), for containing the semi-solid preparation to be injected, between a piston and a base (4) of a needle (3) which comes into contact with one end of said reservoir (1), so that the piston (2) comes into direct contact with said base (4) at the end of injection of the dose contained in said element forming a reservoir, said element forming a reservoir (1) and said needle (3) being held fastened to each other at said base by a support or casing (5, 7) which houses said element forming a reservoir (1).

2. The syringe as claimed in claim 1, prefilled with a dose to be entirely delivered.

3. The syringe as claimed in claim 1 or 2, characterized in that the base (4) is introduced into one end of the reservoir (1).

4. The syringe as claimed in one of claims 1 to 3, characterized in that said support or casing (5, 7) forming the peripheral shell surrounds, with a small or virtually zero clearance, the external surface of said element forming a reservoir (1).

5. The syringe as claimed in claim 4, characterized in that the element or reservoir (1) is cylindrical and introduced and locked inside a hollow body (5) consisting of said support or casing, which provides the protection and the mechanical resistance, especially to pressure, of said syringe.

6. The syringe as claimed in one of claims 1 to 5, characterized in that said cylindrical reservoir (1) is a straight hollow tube having constant internal and external diameters.

7. The syringe as claimed in claim 6, characterized in that the internal diameter of the reservoir (1) is close to or even equal to that of the

internal bore of the needle (3) which extends the reservoir.

8. The syringe as claimed in one of claims 1 to 7, characterized in that a uniform conical or funnel-shaped narrowing is provided toward that end of the reservoir (1) which houses the needle.

9. The syringe as claimed in one of claims 1 to 8, characterized in that the internal diameter of the needle (3) is between 0.2 and 1.2 to 1.5 mm and in that the internal diameter of the reservoir (1), and therefore the diameter of the piston (2) of the syringe, is between 0.2 and 5 mm.

10. The syringe as claimed in claim 9, characterized in that the stroke of the piston (2) has a maximum length of 7 cm in order to inject volumes of 1 to 10 µl and up to 500 µl or 1 ml.

11. The syringe as claimed in either of claims 9 and 10, characterized in that the external diameter of the reservoir (1) is standardized, especially to 6 mm, thereby allowing the aforementioned various internal diameters to be provided.

12. The syringe with a tubular reservoir as claimed in one of claims 6 to 11, in which the reservoir (1) consists of two tubes (1, 32), one placed in the other, so as to increase the resistance to internal pressure.

13. The syringe with a tubular reservoir as claimed in one of claims 6 to 11, in which the tubular reservoir (1) consists of two or more tubes (27, 28), one placed behind the other, which are held in this position by the casing, in particular for facilitating the formation of syringes allowing the administration of different volumes.

14. The syringe as claimed in one of claims 1 to 13, characterized in that the casing (5, 7) consists of two elements, one (5) of which forms a hollow body into which the element forming a reservoir is introduced and the other (7) of which contains the hollow body and traps the reservoir, one of the elements (7) leaving an opening for passage of a piston rod (9) and the other

element leaving an opening for passage of the needle (3).

15. The syringe as claimed in claim 14, characterized in that the opening in said second casing element (7) forms a guide for a piston rod (9) having a diameter approximately equal to the internal diameter of the reservoir.

16. The syringe as claimed in claim 15, characterized in that the second element (7) includes gripping means or finger rests (8).

17. The syringe as claimed in one of claims 1 to 16, characterized in that means are arranged, on said first or second element (5, 7), so as to gear down the injection force or to replace the manual force with a means of mechanical or driving assistance or any other driving means, especially a gas, spring or electromechanical means.

18. The syringe as claimed in claim 17, characterized in that the opening in said second element (13) is threaded in order to engage with a thread (15) on the piston rod so as to allow helical movement of said rod.

19. The syringe as claimed in claim 17, characterized in that said second element (16) has a peripheral thread onto which an internally threaded bush (17) having a central piston rod (18) is screwed.

20. The syringe as claimed in one of claims 1 to 19, characterized in said element forming a reservoir (1) and the needle (3) are assembled, at a needle base (4), without any bonding, clip-fastening or any other positive assembly means, ensuring assembly, and resistance to the forces tending to disassemble its components, by means of said casing (5, 7), said casing being designed to prevent axial separation of the reservoir (1) away from the needle (3).

21. The syringe as claimed in one of claims 1 to 20, characterized in that the piston (2), which may or may not be fastened to a piston rod (9, 15, 18), has a shape which makes it possible to minimize the

resistance to flow and which matches the base (4) of the needle or that end of the reservoir on the same side as the needle so as to leave as small an unused volume as possible when the piston (2) reaches its end-of-injection position.

22. The syringe as claimed in one of claims 1 to 21, forming part of a set of syringes having a constant diameter and a constant length of the reservoir tube (1), making it possible to use the same casing (6, 7) for reservoirs provided for the entire range of formulation doses.

23. The syringe as claimed in one of claims 1 to 22, characterized in that the base (4) of the needle and the piston (2) are made of the same material, especially stainless steel.

24. The syringe as claimed in one of claims 1 to 23, characterized in that, in order to avoid the risk of injection into a vessel, the syringe includes means (46, 47, 48) which make it possible to check whether any blood has been withdrawn from a vessel, this being achieved without having to pull on the piston.

25. The syringe as claimed in claim 24, characterized by a catheter needle allowing blood to be withdrawn by the capillary effect as far as a region open to the outside.

26. The syringe as claimed in one of claims 1 to 25, characterized in that it has a passage, comprising a region (46, 49) visible by the operator, which communicates with the internal bore of the needle and allows, by pressure, capillary effect or vacuum, blood to be seen should the needle have penetrated a vascular lumen.

27. The syringe as claimed in claim 26, characterized in that, should blood be removed by capillary effect, provision is made for the internal bore of the needle to communicate with the external atmosphere via a path (46, 48, 49) providing a pressure drop such that a flow of air is allowed, while the flow

of blood is limited, but that any substantial flow of the semi-solid formulation is unable to take place.

28. The syringe as claimed in either of claims 26 and 27, characterized in that the passage for the blood from the needle (3) passes via the reservoir (1) and includes an elongate pressure-drop path (46).

29. The syringe as claimed in claim 28, characterized in that said elongate path (26) is between a thread or groove on the base (4) of the needle and a complementary surface in the transparent wall of the reservoir (1), or vice versa, this thread (4) communicating at its end, directly or through a display region, with the external atmosphere via a small-diameter hole (48).

30. The syringe as claimed in claim 26, characterized in that the inside of the needle and of the reservoir is maintained under vacuum so that a withdrawal of blood will, by pressure difference, emerge in a display region.

31. The syringe as claimed in claim 30, characterized in that it includes a display region not communicating with the atmosphere.

32. The syringe as claimed in one of claims 1 to 31, characterized in that the needle is covered by a cap (52), a package (54) or other flexible protection element which isolates it from the outside and which will be transpierced by the needle at the moment of injection, this cap, package or protection element being retractable, deformable or foldable in order to move away during penetration of the needle and to permit penetration of all or most of the length of the needle.

33. The syringe as claimed in claim 32, characterized in that the inside of the syringe is under vacuum.

34. The syringe as claimed in either of claims 32 and 33, characterized in that said package consists of a tube (52) or a sachet (54) made of plastic, sealed around the needle (3) or onto the latter.

35. The syringe as claimed in claim 34, characterized in that said package (52), which completely isolates the needle (3) from the outside is sealed at the end of the needle, especially by heat sealing, so as to completely close off the end of the needle in the manner of a plug.

36. The syringe as claimed in claim 32, in which any withdrawal of blood, being withdrawn by capillary effect, may be seen, characterized in that the hole connecting the pressure-drop passage to the external environment emerges, in fact, inside this package so that no communication actually exists between a non-sterile atmosphere and the inside of the needle.

37. The syringe as claimed in one of claims 32 to 36, characterized in that said cap, package or protection element is fixed to the front end of the reservoir (1).

38. The syringe as claimed in one of claims 1 to 37, characterized in that the prefilling is such that the volume of the formulation occupies the entire space between the piston and the needle without it being necessary to purge the syringe before injection.

39. The syringe as claimed in one of claims 1 to 38, characterized in that the piston (2) is not fastened to the piston rod and is pushed back by the latter in the injection direction.

40. The syringe as claimed in one of claims 1 to 39, characterized in that a seal is interposed between the base (4) of the needle and the reservoir (1) in order to be clamped when they are being fitted into the support or casing (5, 7).

41. The syringe as claimed in one of claims 1 to 39, characterized in that a seal (8) is interposed between the reservoir (1) and the casing (5, 7) in order to prevent any communication with an interstice located between the reservoir and the casing (5, 7).

42. A process for filling a syringe as claimed in one of claims 1 to 41, in which a filling nozzle is connected to said tube or reservoir (1), plugged by

said piston (2) or by a septum, and in which said piston (2) is displaced by the filling of the formulation, said tube then being plugged by said base (4) of the needle.

43. The filling process as claimed in claim 42, in which said tube is packaged beforehand in a package and in which it is plugged by introducing it into the hollow body of said casing containing the needle and carrying the cap, all of this being inside a second package.